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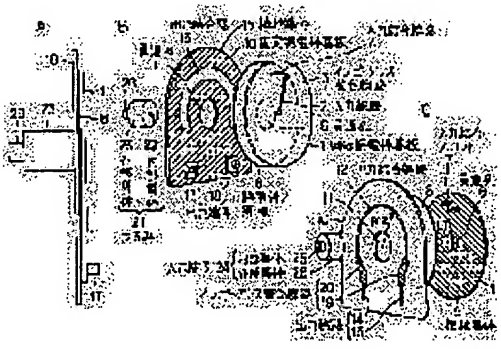
(54) PHASE SHIFTER



(57)Abstract:
PROBLEM TO BE SOLVED: To provide the phase shifter by which high-frequency power is distributed and a phase shift amount of each distributed power is easily adjusted continuously in details.
SOLUTION: Inner surfaces of a boards 1, 10 are opposite to each other, lines 2, 3 and an input coupling line 4 are provided to an outer surface of the board 1, a slot 7 is formed on the board 1 except the part of a ground conductor 5 provided to an inner surface of the board 1, an output coupling line 12, lines 19, 20, 13, 14 and terminals 17, 18 are provided to an outer surface of the board 10, a window 16 is provided on the board 10 except the part of a ground conductor 15 provided on the inner surface, an outre conductor 23 of a turning drive knob 21 is fixed to the ground conductor 5 of the board 1, and an inner

conductor 22 of the knob 21 is connected to the line 2. A high-frequency power fed to a coaxial plug 24 excites an exciting circuit, consisting of the line 4 and the slot 7 via the knob 21 and the lines 2, 3, the exciting circuit consisting of the line 12 and the window 16 is excited by an electromagnetic wave from the exciting circuit, the power produced in the line 12 is halved at an exciting point and outputted from the terminals 17, 18. When the board 1 is rotated, the exciting point of the line 12 is moved in the circumferential direction, so as to change each phase shift amount of the outputs from the terminals 17, 18.

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CLAIMS

[Claim(s)]
[Claim 1] The phase shifter characterized by providing the following. The rotation dielectric substrate and fixed dielectric substrate which each internal surface is opposed and counter. The input-line way where it is prepared in the outside surface of the aforementioned rotation dielectric substrate, and an inner edge is located in the center of

rotation of the aforementioned rotation dielectric substrate. The coupling track connected to the outer edge of the aforementioned input-line way through a direct or impedance matching track. grounding prepared in the internal surface of the aforementioned rotation dielectric substrate -- with a conductor and the breakthrough prepared in the center of rotation of the aforementioned rotation dielectric substrate grounding prepared in the internal surface of the aforementioned rotation dielectric substrate -- grounding of the part corresponding to the coupling track established in the outside surface of the aforementioned rotation dielectric substrate among conductors -- a conductor with the coupling slot removed and formed It is prepared in the outside surface of the aforementioned fixed dielectric substrate. a radius (R12) from a common medial axis with the aforementioned rotation dielectric substrate The inside of the coupling slot prepared in the internal surface of the aforementioned rotation dielectric substrate, The circular wired-AND track of the length of the portion almost corresponding to radial [of the aforementioned rotation dielectric substrate] almost equal to the length (L7) from a midpoint to the center of rotation of the aforementioned rotation dielectric substrate, The output-line way which is established in the outside surface of the aforementioned fixed dielectric substrate, and is connected to each edge of the aforementioned wired-AND track through a direct or impedance matching track, grounding prepared in the internal surface of the aforementioned fixed dielectric substrate -- a conductor and its grounding -- grounding of the part corresponding to the wired-AND track established in the outside surface of the aforementioned fixed dielectric substrate among conductors -- a conductor with the wired-AND aperture removed and formed The inner conductor connected to the inner edge of the input-line way which was inserted in the breakthrough prepared in the center of rotation of the aforementioned rotation dielectric substrate, and was established in the outside surface of the aforementioned rotation dielectric substrate, It consists of the outer conductor combined with a conductor electrically mechanically. grounding which pierced through the breakthrough which was mostly prepared in the shape of the same axle through this inner conductor and insulator, and was prepared in the aforementioned fixed dielectric substrate the aforementioned rotation dielectric substrate and in the shape of the said heart, and was prepared in the internal surface of the aforementioned rotation dielectric substrate -- While connecting with the inner conductor of the tongue for a rotation drive used for adjustment of the amount of phase shifts, and the tongue for the aforementioned rotation drive in capacity While connecting with the inner conductor of the tongue for this rotation drive, the inner conductor attached in the surroundings of a common axis free [rotation], and the outer conductor of the tongue for the aforementioned rotation drive in capacity The coaxial plug of the input side which consists of the outer conductor of the tongue for this rotation drive, and the outer conductor attached in the surroundings of a common axis free [rotation].

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to a phase shifter possible carrying out change adjustment of the Gentlemen phase of the distributed power continuously and minutely for example, suitable as a constituent child of the tilt angle control unit of the array antennas for base stations in mobile communications while distributing RF power.
[0002]
[Description of the Prior Art] In the mobile communications method of land, such as a car telephone and a cellular phone, using the limited frequency effectively is performed by increasing the number of base stations, narrowing the service area of each base station, and making the repeat usage count of frequency increase. While controlling so that the tilt angle of the radiation beam of the array antennas in each base station becomes deep in order to narrow the service area of each base station, mutual adjustment of a tilt angle is needed between adjoining base stations so that the blind zone of an electric wave may not arise.
[0003] It considers as the means to which the tilt of the radiation beam is carried out where an antenna is stood perpendicularly mechanically, without making an antenna incline in a slanting lower part, since the above purposes are attained. While connecting a feeder way for every antenna block which arranged the element antenna in multi-stage, formed array antennas perpendicularly, and connected the feeder way to it for every element antenna conventionally, or formed two or more element antennas collectively suitably Form shortest the length of the feeder way connected to the element antenna of the best stage, or an antenna block, and it forms so that it may become long one by one as the feeder way connected to the element antenna of a bottom or an antenna block is reached. It forms so that a phase may be overdue one by one as the phase distribution of the excitation power of element ATENNA or an antenna block results in the element antenna of the best stage, the element antenna of an antenna block to a bottom, or an antenna block. The antenna formed so that the direction of the maximum gain of array antennas might be suitably leaned to a slanting lower part from the level surface is used.
[0004]
[Problem(s) to be Solved by the Invention] Although it is necessary in the above-mentioned conventional tilt-beam antenna to change the length of each feeder way in order to change a CHIRUKU angle Although it is restricted when the feeder way which is going to change length tends to be removed from a connector, and it is going to replace with the feeder way where length's differs or it is going to shorten the length of a feeder way in order to change the length of a feeder way Instead of replacing a feeder way with a short feeder way, the feeder way removed from the connector is cut, it shortens, and, in any [of attaching this in a connector again] case, the work which requires very much an effort and time is needed.
[0005] Since it is general to perform water proofing, such as to wind a waterproofing tape around the periphery of a feeder way and the periphery for a connection with a connector, when the feeder way is prepared out of office **, the complicated work of removal of a

waterproofing tape and re-wearing will be added in changing of a feeder way. Therefore, in order to prevent the blind zone of an electric wave arising, when the need of performing frequently mutual adjustment of the tilt angle between adjoining base stations arises, change of the length of a feeder way is not easy.

[0006] Moreover, in changing the length of a feeder way, it is impossible it not only to require the above complicated work, but to change the length of a feeder way minutely and continuously. In order to change a tilt angle, without requiring the above complicated changing The length of each feeder way is formed equally mutually. The solid state switch of parallel connection [much] type, Although the tilt angle control unit constituted so that the series connection of the phase shifter which connects the transmission line from which length differs mutually for every solid state switch, and changes might be carried out for every feeder way and the total track length of a feeder way and the transmission line of a phase shifter might be changed by switch opening and closing of a solid state switch is also used Since a solid state switch is not only comparatively inferior to a power-proof property, but a solid state switch is essentially a nonlinear element, to the transmission-and-reception common antenna system of the mobile communications base station where a demand severe about a nonliner distortion is imposed, use of the above phase shifters is not desirable.

[0007]

[Means for Solving the Problem] The rotation dielectric substrate and fixed dielectric substrate which the phase shifter of this invention opposes each internal surface, and counter are prepared. The input-line way where it is prepared in a rotation dielectric substrate at the outside surface, and an inner edge is located in the center of rotation of the aforementioned rotation dielectric substrate, The coupling track connected to the outer edge of the aforementioned input-line way through a direct or impedance matching track, grounding prepared in an internal surface -- a conductor, the breakthrough prepared in the center of rotation, and grounding prepared in the internal surface -- grounding of the part corresponding to the coupling track established in the outside surface of a rotation dielectric substrate among conductors -- the coupling slot which removes a conductor and is formed is established

[0008] It is prepared in a fixed dielectric substrate at the outside surface. the radius (R12) from a common medial axis with a rotation dielectric substrate The circular wired-AND track of the length of the portion almost corresponding to radial [among the coupling slots of a rotation dielectric substrate] almost equal to the length (L7) from a midpoint to the center of rotation, The output-line way which is established in an outside surface and connected to each edge of a wired-AND track through a direct or impedance matching track, grounding prepared in an internal surface -- a conductor and its grounding -- grounding of the part corresponding to the wired-AND track of the fixed dielectric substrate among conductors -- the wired-AND aperture which removes a conductor and is formed is prepared

[0009] Moreover, the tongue for a rotation drive and the coaxial plug of an input side are prepared in the phase shifter of this invention. the breakthrough which the tongue was inserted in the breakthrough of a rotation dielectric substrate, was mostly prepared in the shape of the same axle through the inner conductor connected to the inner edge of the input-line way, and this inner conductor and insulator, and was prepared in the fixed dielectric substrate a rotation dielectric substrate and in the shape of the said heart --

piercing -- grounding of a rotation dielectric substrate -- it consists of the outer conductor combined with a conductor electrically mechanically

[0010] A coaxial plug consists of the inner conductor attached in the surroundings of the inner conductor of the tongue for this rotation drive, and a common axis free [rotation] while connecting with the inner conductor of the tongue for a rotation drive in capacity, and the outer conductor attached in the surroundings of the outer conductor of the tongue for this rotation drive, and a common axis free [rotation] while connecting with the outer conductor of the tongue for a rotation drive in capacity.

[0011]

[Embodiments of the Invention] The side elevation in which drawing 1 A shows one example of invention of a claim 1, and drawing 1 B Decomposition perspective diagram and drawing 1 C seen from the diagonal right front of drawing 1 A With the decomposition perspective diagram seen from the diagonal left front of drawing 1 A, it sets to drawing. 1 A rotation dielectric substrate (it is also only called a rotation substrate), As for dielectric sheet metal (it is also only called sheet metal) and 10, 8 is [a fixed dielectric substrate (it is also only called a fixed substrate) the outer conductor of the tongue for / 17 / a rotation drive in an output terminal and 23, and 26] the outer conductors of an input terminal.

[0012] Drawing in which drawing 2 A and B shows the outside surface and internal surface of the rotation dielectric substrate 1 of drawing 1 , i.e., an input-side dielectric substrate with a circular profile configuration, respectively, drawing in which drawing 3 shows the plate surface of dielectric sheet metal 8 with the circular profile configuration of drawing 1 , and drawing 4 A and B are drawings showing the outside surface and internal surface of the fixed dielectric substrate 10 of drawing 1 , i.e., an output side dielectric substrate, respectively. As shown in drawing 1 B and drawing 2 A, an inner edge is located at the center of the rotation substrate 1 at the outside surface of the rotation substrate 1, and the coupling track 4 connected to the outer edge of the input-line way 2 of proper length where an outer edge is prolonged in radial, the impedance matching track 3 connected to the outer edge of the input-line way 2 if needed, and the impedance matching track 3 is formed.

[0013] A conductor 5 is formed. grounding which continues throughout an internal surface and changes from copper etc. to the internal surface of the rotation substrate 1 as shown in drawing 1 C and drawing 2 B -- While the point of the inner conductor 22 of the tongue 21 for a rotation drive which opens a breakthrough 6 in the center of the rotation substrate 1, and mentions the bore later selects so that it may be inserted by suitable hard or hardness grounding prepared in the inner conductor 22 of a tongue 21, and the internal surface of the rotation substrate 1 -- surrounding grounding of a breakthrough 6 in order for a conductor 5 to prevent contacting electrically -- the conductor 5 is removed [the range] suitably

[0014] moreover, grounding prepared in the internal surface of the rotation substrate 1 -- grounding in the part corresponding to the coupling track 4 established in the outside surface of the rotation substrate 1 among conductors 5 -- a conductor -- a portion is removed and the coupling slot 7 is formed The coupling slot 7 prepared in the internal surface of the rotation substrate 1 The length of the radial element slotted section of the proper length which is mostly in agreement with radial [of the rotation substrate 1 which is the part] mostly a midpoint A correspondence position is carried out in the part of one

fourth of length. about [of the open outer edge (the edge in connection linked to the outer edge of the impedance matching track 3, and edge of an opposite side) of the coupling track 4 established in the outside surface of the rotation substrate 1 to operating wavelength] -- It is mutual almost parallel to the radial outer edge and radial inner edge of an element slotted section respectively, and one edge each of the parallel element slotted section of the outside used as a retrose and the inside is combined, and it has formed so that the configuration of the coupling slot 7 whole may accomplish a lightning form mostly.

[0015] The strip line is formed of a conductor 5. grounding prepared in the dielectric quality of the material of the input-line way 2 established in the outside surface of the rotation substrate 1, and the rotation substrate 1, and the internal surface of a substrate 1 -- Although an input-side excitation circuit is formed of the coupling slot 7 prepared in the coupling track 4 established in the outside surface of the rotation substrate 1, and the internal surface Since each circuitry differs and, as for this strip line and an input-side excitation circuit, mutual circuit impedances differ in many cases, It is desirable to make the impedance matching track 3 intervene between the input-line way 2 and the coupling track 4 if needed, to select suitably the width of face and track length, and to aim at adjustment of an impedance.

[0016] The plate surface of dielectric sheet metal 8 provides the breakthrough 9 in which the outer conductor of the tongue for a rotation drive later mentioned at the center is inserted, as the plate surface which faces the rotation substrate 1, and its rear face are the same composition and are shown in drawing 3 . In addition, as for sheet metal 8, it is desirable to form the diameter almost equally to the diameter of the rotation substrate 1.

[0017] As shown in the fixed substrate 10 at drawing 1 and drawing 4 , at the center which is in agreement with the rotation substrate 1 and a common medial axis The breakthrough 11 for insertion of the outer conductor 23 of the tongue 21 for a rotation drive mentioned later is formed. to the outside surface of the fixed substrate 10 As shown in drawing 1 C and drawing 3 A, the circular wired-AND track 12 centering on the center of a breakthrough 11 is formed. The radial element slotted section which forms a part of coupling slot 7 which formed the radius R12 in the internal surface of the rotation substrate 1 is formed almost equally to the length L7 between a midpoint and the center of rotation of the rotation substrate 1.

[0018] In drawing 1 C and drawing 4 A, the interval of each heel of the output-line ways 13 and 14 and the center (center of a breakthrough 11) of the fixed substrate 10 is made into size more suitably than each radius of the rotation substrate 1 and sheet metal 8, and it has formed so that there may be no possibility that the output terminals (it mentions later) 17 and 18 connected to each heel of the output-line ways 13 and 14 may contact each periphery of the rotation substrate 1 and sheet metal 8.

[0019] grounding which changes from copper etc. to the internal surface of the fixed substrate 10 throughout an internal surface as shown in drawing 1 B and drawing 4 B -- grounding in the part corresponding to the wired-AND track 12 which formed the conductor 15 and was established in the outside surface among the internal surfaces of the fixed substrate 10 -- a conductor is removed and the wired-AND aperture 16 is formed Two circular edges [aperture / wired-AND / 16] centering on the center of a breakthrough 11, It is surrounded mostly at two radial edges. the circular center line L1 (drawing 4 B) between each circular edge of an outside and the inside It corresponds to

the circular center line of the wired-AND track 12 of the fixed substrate 10 mostly. the length of the wired-AND aperture 16 radii-like center line L1 It forms almost equally to the length in alignment with the radii of the wired-AND track 12. The outside of the wired-AND aperture 16, and the opposite interval of each inside circular edge, That is, it is almost equal to the length of the radial element slotted section of the coupling slot 7 of the rotation substrate 1, or the width of face of the wired-AND aperture 16 is suitably formed in size.

[0020] In forming output terminals 17 and 18 by the coaxial [it / it] plug A conductor is removed [the proper range]. surrounding grounding of the breakthrough (insertion of the inner conductor of a coaxial plug hole) prepared in the plate surface of the fixed substrate 10 corresponding to each heel of the output-line ways 13 and 14 established in the outside surface of the fixed substrate 10 -- grounding -- without a conductor 15 contacts the inner conductor of a coaxial plug -- grounding -- it forms so that connection between a conductor 15 and the outer conductor of a coaxial plug may be secured

[0021] grounding in the internal surface of the rotation substrate 1 which counters through the wired-AND track 12 established in the outside surface of the fixed substrate 10, and the wired-AND aperture 16 and the dielectric sheet metal 8 which were prepared in the internal surface -- an output side excitation circuit is formed of the strip line which consists of a conductor 5 moreover, grounding prepared in the dielectric quality of the material of the output-line ways 13 and 14 established in the outside surface of the fixed substrate 10, and the fixed substrate 10, and its internal surface -- the strip line is formed of a conductor 15 Since each circuitry differs and mutual circuit impedances differ in many cases, as for the strip line which forms this strip line and an output side excitation circuit, it is desirable to make the impedance matching tracks 19 and 20 intervene if needed between each edge of the wired-AND track 12 and each **** of the output-line ways 13 and 14, to select suitably each of that width of face and each track length, and to aim at adjustment of an impedance.

[0022] in drawing 1 , 21 is a tongue for a rotation drive and intervenes an insulator between an inner conductor 22 and an outer conductor 23 -- making -- both -- while insulating a conductor electrically -- both -- a conductor is maintained in the shape of the same axle, and it is made to have combined with one mechanically 24 is an input terminal and is a coaxial plug which consists of an inner conductor 25 and an outer conductor 26. An inner conductor 25 can rotate freely relatively around this axis by pinching with the inner conductor 25 and the inner conductor 22 of 21 making an axis in agreement mutually, and it connects mutually electrically through capacity. An outer conductor 26 can rotate freely relatively around this axis by pinching with the outer conductor 26 of an input terminal 24, and on the other hand, the outer conductor 23 of 21 making an axis in agreement mutually, and it connects mutually electrically through capacity.

[0023] That is, the rotary joint is formed by the tongue 21 and the input terminal 24. Oppose the internal surface of the rotation substrate 1, and the internal surface of the fixed substrate 10 on both sides of dielectric sheet metal 8 in assembling the phase shifter of this invention in between to be shown in drawing 1 . Pinch to the breakthroughs 11 and 9 of the fixed substrate 10 and sheet metal 8, and the outer conductor 23 of 21 is inserted. while inserting the point of the inner conductor 22 of a tongue 21 in the breakthrough 6 of the rotation substrate 1 and fixing the end face to the internal surface of the inner edge (edge located at the center of the rotation substrate 1) of the input-line way 2 -- the outer

conductor 23 of a tongue 21 -- grounding -- it fixes to a conductor 5 mechanically and connects with it electrically

[0024] Although the interior of these is carried out to a shielding case (not shown in drawing 1) after combining the rotation substrate 1, sheet metal 8, the fixed substrate 10, a tongue 21, and an input terminal 24 as mentioned above The input-line way 2 established in the outside surface of the rotation substrate 1, the impedance matching track 3 prepared if needed, and the coupling track 4 A suitable spacer is made to intervene in order to make rotation of the rotation substrate 1 smooth, without contacting the outside surface of the rotation substrate 1, and the internal surface of the shielding case which counters. Moreover, a suitable spacer is made to intervene in order for the wired-AND track 12 established in the outside surface of the fixed substrate 10, the output-line ways 13 and 14, and the impedance matching tracks 19 and 20 prepared if needed to prevent contacting the outside surface of the fixed substrate 10, and the internal surface of the shielding case which counters.

[0025] The cross-section configuration of a wall portion where consist of the frame of the proper thickness which consists, for example of a solid dielectric as the above-mentioned spacer, and the internal structure of a shielding case approaches each periphery of the rotation substrate 1 and sheet metal 8 is circular. When the cross-section configuration of the wall portion close to the periphery of the fixed substrate 10 is equivalent to the profile configuration of the fixed substrate 10 The spacer infixed between the outside surface of the rotation substrate 1 and the internal surface of a shielding case is formed in the shape of a ring, and forms the spacer infixed between the outside surface of the fixed substrate 10, and the internal surface of a shielding case with the frame corresponding to the profile configuration of the fixed substrate 10.

[0026] Moreover, when output terminals 17 and 18 are formed by the coaxial plug as mentioned above in connecting between output terminals 17 and 18 and the output terminals prepared in the shielding case, the output terminal prepared in a shielding case is also formed by the coaxial plug, and connects between these coaxial plugs by the coaxial track. When forming the output terminals 17 and 18 prepared in the internal surface of the fixed substrate 10 by the coaxial plug, each axial length of each inner conductor and an outer conductor is formed for a long time suitably, it may insert in the breakthrough which prepared these in the wall surface of a shielding case, and you may form so that each edge may be exposed outside.

[0027] Furthermore, in order to hold the rotation substrate 1 in a necessary rotation position, between a tongue 21 and the wall surface of a shielding case, a screw is minced to the peripheral surface conventionally exposed to the exterior of a shielding case among the peripheral faces of the outer conductor 23 of the suitable well-known lock mechanism 21, for example, a tongue, and the lock mechanism of making this screw screw a locknut etc. is established. the RF power applied to the input terminal 24 -- the inner conductor 22 and outer conductor 23 of a tongue 21 -- minding -- the input-line way 2 of the rotation substrate 1, and grounding -- it is added to a conductor 5 and the input-side excitation circuit which consists of the coupling track 4 and the coupling slot 7 is excited through the impedance matching track 3 prepared the input-line way 2 and if needed

[0028] grounding of the rotation substrate 1 which the electromagnetic wave produced from the input-side excitation circuit counters through the wired-AND aperture 16 of dielectric sheet metal 8 and the fixed substrate 10 -- the output side excitation circuit

which consists of the wired-AND track 12 of a conductor 5 and the fixed substrate 10 is excited The RF power produced on the wired-AND track 12 by this excitation The power which was distributed to right and left bordering on the exciting point, transmitted the wired-AND track 12 to the retrose mutually, and was transmitted in the right direction The power which outputted from the terminal 17 through the impedance matching track 19 and the output-line way 13 which are prepared if needed, and was transmitted to the opposite direction is outputted from a terminal 18 through the impedance matching track 20 and the output-line way 14 which are prepared if needed.

[0029] When the length of the track from an exciting point to a terminal 17 and the length of the track to a terminal 18 are mutually equal, the amount of phase shifts of the power to a terminal 17 from an exciting point and the amount of phase shifts of the power to a terminal 18 from an exciting point are mutually equal, and the power outputted from terminals 17 and 18 serves as this amplitude by the antiphase mutually. The length of the track to [if the tongue 21 for a rotation drive is operated and the rotation substrate 1 is rotated / according to this angle of rotation, the exciting point of the wired-AND track 12 will carry out move change at a circumferencial direction, and] an output terminal 17 from an exciting point, The length of the track which results in an output terminal 18 will differ mutually, and the amount of phase shifts of the power outputted from the terminal connected to the near track on which the amount of phase shifts of the power outputted from the terminal connected to the near track in which the length from an exciting point became short became smallness, and the length from an exciting point became long serves as size.

[0030] While lengthening length L7 between the simultaneously midpoint (a correspondence position is carried out from the open outer edge of the coupling track 4 of the rotation substrate 1 in the part of the length of the simultaneouslies 1/4 of operating wavelength) of the length of the radial element slotted section of the coupling slot 7 of the rotation substrate 1, and the center of rotation of the rotation substrate 1 According to increase of this length, the radius R12 of the wired-AND track 12 of the fixed substrate 10 is made into size. The variability region of the amount of phase shifts can be made into size by lengthening the overall length of the output circuit which consists of the wired-AND track 12, the impedance matching tracks 19 and 20 prepared if needed, and the output-line ways 13 and 14.

[0031] The following prototypes were produced in order to perform the performance test of this invention phase shifter. Operating frequency with a 800MHz band namely, the coupling track 4 of the rotation substrate 1 It forms in the shape of [centering on the center of rotation of the rotation substrate 1] radii. the length of the radii It chooses as one half. about [of operating wavelength] -- with the actual length of the coupling slot 7 of the lightning type of the rotation substrate 1, i.e., the length of the radial element slotted section of the coupling slot 7 The sum of the length of an outside parallel element slotted section and the length of an inside parallel element slotted section was formed in the length of the simultaneouslies 1/2 of operating wavelength.

[0032] The frequency characteristic of a return loss in case the angle of rotation of the rotation substrate 1 measured using the prototype is 0 degree, transmission loss, and the amount of phase shifts is shown in drawing 5 . By in addition, the electromagnetic wave from the input-side excitation circuit which consists of the coupling track 4 and the coupling slot 7 in the rotation substrate 1 The case where it is in the midpoint of the

overall length of the output circuit to which the exciting point produced on the wired-AND track 12 in the fixed substrate 10 changes from the wired-AND track 12 connected among output terminals 17 and 18, the impedance matching tracks 19 and 20 prepared if needed, and the output-line ways 13 and 14 Suppose that the angle of rotation of the rotation substrate 1 is 0 degree.

[0033] In drawing 1 B, 30 degrees, 60 degrees, and the various properties at the time of rotating 90 degrees are shown in drawing 6 , drawing 7 , and drawing 8 to a counterclockwise rotation, respectively from the rotation position of 0 degree which explained the rotation substrate 1 of this invention phase shifter about drawing 5 . In these drawings, the return loss of A is a value in an input terminal 24. In the transmission loss and the amount of phase shifts of B and C, a solid line and a dashed line are the values observed in output terminals 17 and 18, respectively.

[0034] In the case of which [which made it rotate counterclockwise], the input impedance characteristic is kept stable to not only when the angle of rotation of the rotation substrate 1 is kept at 0 degree in this invention phase shifter so that clearly from the return loss frequency characteristic of A, but 30 degrees, 60 degrees, and 90 degrees. Moreover, when the angles of rotation of the rotation substrate 1 are any which are 0 degree, 30 degrees, 60 degrees, and 90 degrees so that clearly from the transmission loss frequency characteristic of B, the output swing of output terminals 17 and 18 is kept almost constant.

[0035] As shown in drawing 5 C, when the angle of rotation of the rotation substrate 1 is 0 degree, the difference of each amount of phase shifts of output terminals 17 and 18 covers a latus frequency range (about 750MHz or about 1050MHz), and is kept at about 180 degrees. However, as shown in drawing 6 C or drawing 8 C, with 30 degrees, 60 degrees, and 90 degrees, it is alike, therefore the amount of phase shifts of an output terminal 17 progresses gradually, and the angle of rotation of the rotation substrate 1 has the increasing inclination for the amount of phase shifts of an output terminal 18 to be overdue gradually.

[0036] Drawing 9 shows the result which observed the relation between the angle of rotation of the rotation substrate 1 of this invention phase shifter, and the amount of phase shifts of output terminals 17 and 18 about 885MHz of center frequency. When the angles of rotation of the rotation substrate 1 are 0 degree, 30 degrees, 60 degrees, and 90 degrees, the amounts of phase shifts of an output terminal 17 are about 20 degrees, 70 degrees, 118 degrees, and 163 degrees, and the amount of phase shifts of an output terminal 17 will progress almost linearly as the angle of rotation of a substrate 1 changes strangely from 0 degree to 90 degrees. On the other hand, in the case of 0 degree, 30 degrees, 60 degrees, and 90 degrees, the angles of rotation of the rotation substrate 1 are about 194 degrees (=-166 degree), 145 degrees, 95 degrees, and 47 degrees, and the amount of phase shifts of an output terminal 18 will be in the amount of phase shifts of an output terminal 18 almost linearly as the angle of rotation of the rotation substrate 1 changes from 0 degree to 90 degrees.

[0037] Although observation when the above rotates the rotation substrate 1 counterclockwise was shown The wired-AND track 12 of the fixed substrate 10, the impedance matching tracks 19 and 20 prepared if needed, the output-line ways 13 and 14, and the wired-AND aperture 16 When rotating the rotation substrate 1 clockwise by forming in a bilateral symmetry to the midpoint of the sum total track length between

output terminals 17 and 18, many properties of having the same inclination as what was shown in drawing 5 or drawing 9 can be given.

[0038] Drawing 10 A and B is drawings showing the outside surface and internal surface of the rotation dielectric substrate 1 which are the example of invention of a claim 4, respectively, and has attached the same sign as drawing 1 and a corresponding portion. The radial element slotted section of the proper length as for which 7-1 is a coupling slot and which is mostly in agreement with radial [of the rotation substrate 1] is formed. Mostly, although it is the same as that of the example of the length of an element slotted section radial [this] which showed the point of operating wavelength made [the part of one fourth of length] to carry out a correspondence position mostly to drawing 1 and drawing 2 from the open outer edge of the coupling track 4, a midpoint In the example of drawing 10 , the sense of the parallel element slotted section of the outside combined with the outer edge of a radial element slotted section It is made to join together so that it may become the sense of an inside parallel element slotted section and the same direction which are combined with the inner edge of a radial element slotted section, and it has formed so that the configuration of the seven to coupling slot 1 whole may accomplish the typeface of reverse KO mostly. In addition, when rotating 180 degrees of rotation substrates 1 around a center-of-rotation shaft from the state of drawing 10 , it can call that the configuration of the seven to coupling slot 1 whole serves as a typeface of KO mostly.

[0039] Oppose the internal surface of the rotation substrate 1, and the internal surface of the fixed substrate 10 on both sides of dielectric sheet metal 8 like the case of drawing 1 also in the example of drawing 10 in between. Pinch to the breakthrough 9 prepared in the breakthrough 11 prepared in the fixed substrate 10, and sheet metal 8, and the outer conductor 23 of 21 is inserted. While inserting in the breakthrough 6 which prepared the point of the inner conductor 22 of a tongue 21 in the core of the rotation substrate 1 and fixing the apical surface of the inner conductor 22 of a tongue 21 at the inner edge of the input-line way 2 the outer conductor 23 of a tongue 21 -- grounding of the rotation substrate 1 -- connection fixing is carried out and the interior of the rotation substrate 1, sheet metal 8, and the fixed substrate 10 is carried out to a conductor 5 at a shielding case This is the same also in each example of drawing 11 or drawing 14 .

[0040] Also in the example of drawing 10 , in addition, the coupling track 4 established in the outside surface of the rotation substrate 1 It chooses as one half. it centers on the center of rotation of the rotation substrate 1 -- circular -- forming -- the length of the radii -- about [of operating wavelength] -- with the length of the parallel element slotted section of the outside of the coupling slot 7-1 of the rotation substrate 1 While forming the sum of the length of a radial element slotted section, and the length of an inside parallel element slotted section in the simultaneouslies 1/2 of operating wavelength The property very near the various properties which showed the width of face of the wired-AND aperture 16 of the fixed substrate 10 to drawing 5 or drawing 9 by being almost equal to the length of the radial element slotted section of the coupling slot 7-1 of the rotation substrate 1, or forming in size suitably can be given.

[0041] The outside surface and internal surface of the rotation dielectric substrate 1 which are the example of invention of a claim 5, respectively are shown in drawing 11 A and B using the same sign as the former. The length of the radial element slotted section which 7-2 is a coupling slot and forms the part mostly a midpoint It forms so that a

correspondence position may be carried out in the part of the length of the simultaneouslies 1/4 of operating wavelength from the open outer edge of the coupling track 4-3 of the rotation substrate 1. The simultaneously midpoint of the longitudinal direction of each parallel element slotted section of an outside and the inside is combined, respectively, so that about T typefaces may be accomplished, and it has formed in the radial outer edge and radial inner edge of an element slotted section so that the configuration of the seven to coupling slot 2 whole may accomplish the typeface of E mostly.

[0042] the example of drawing 11 -- also setting -- one open outer edge [of the length of the coupling slot 7-2, i.e., an outside parallel element slotted section,] [-- for example pass a radial element slotted section from left-hand side outer edge [open]] toward drawing 11 B -- open outer edge [of another side of an inside parallel element slotted section] [-- for example one open outer edge [of the length which results in right-hand side open outer edge] toward drawing 11 B, and an inside parallel element slotted section] [-- for example pass a radial element slotted section from left-hand side outer edge [open]] toward drawing 11 B -- open outer edge [of another side of an outside parallel element slotted section] [-- for example While selecting the length which results in right-hand side open outer edge] toward drawing 11 B to the simultaneouslies 1/2 of operating wavelength, respectively The property very near the various properties which showed the width of face of the wired-AND aperture 16 of the fixed substrate 10 to drawing 5 or drawing 9 by being almost equal to the length of the radial element slotted section of the coupling slot 7-2, or selecting in size suitably can be given.

[0043] The outside surface and internal surface of the rotation dielectric substrate 1 which are the example of invention of a claim 6 are shown in drawing 13 A and B using the same sign as the former. 7-3 is a coupling slot, the longitudinal direction carries out simultaneously coincidence radial [of the rotation substrate 1], and the midpoint of the length carries out the correspondence position of it from the open outer edge of the coupling track 4 in the part of the length of the simultaneouslies 1/4 of operating wavelength.

[0044] Also in the example of drawing 12 , the property very near the various properties which showed the length of the coupling slot 7-3 to drawing 5 or drawing 9 by forming the width of face of the wired-AND aperture 16 prepared in the internal surface of the fixed substrate 10 while forming in one half mostly of operating wavelength in the length which is equal to the length of the coupling slot 7-3 mostly can be given. Drawing 13 A and B is drawings showing the outside surface and internal surface of the rotation dielectric substrate 1 which are the example of invention of a claim 7, respectively, and has attached the same sign as the former. 4-4 is a coupling track, and it is connected so that about T typefaces may be accomplished on the outside of the impedance matching track 3 in which a midpoint is prepared mostly the input-line way 2 or if needed of the longitudinal direction.

[0045] grounding of the part corresponding to [7-4 is a coupling slot and] the coupling track 4-4 -- while removing and forming a conductor and making the overall length suitably longer than the overall length of the coupling track 4-4, the width of face is suitably formed in size compared with the width of face of the coupling track 4-4 Also in the example of drawing 13 , although the RF power produced on the wired-AND track 12 established in the outside surface of the fixed substrate 10 is distributed to right and left

bordering on an exciting point by the electromagnetic wave from the input-side excitation circuit which consists of the coupling track 4-4 and the coupling slot 7-4 and transmits the wired-AND track 12 to an opposite direction mutually by it, in this example, the output phase of terminals 17 and 18 becomes in phase mutually.

[0046] Moreover, also in this example, it can form circularly and other properties except the phase shift property which showed the length [track / coupling / 4-4] in alignment with the radii centering on the center of rotation of the rotation substrate 1 in C view among the properties shown in drawing 5 or drawing 8 by / of operating wavelength / forming in one half mostly, and the same property can be given. Drawing 14 A and B is the examples of invention of a claim 8, respectively. The sign same in drawing showing the outside surface and internal surface of the rotation dielectric substrate 1 as the former and a corresponding portion is attached.

[0047] 7-5 is a coupling slot and consists of the following 1st E type slots 7-5-1 and the 2nd E type slot 7-5-2. the 1st E type slot 7-5-1 -- the rotation substrate 1 -- it prepares in radial mostly -- having -- the midpoint of the longitudinal direction -- one open outer edge [of the coupling track 4-4] [-- for example drawing 14 A -- going -- about [of right-hand side outer edge / open /] to operating wavelength] -- 1st radial element slotted-section [which carries out a correspondence position in the part of one fourth of length] [-- for example It consists of the parallel element slotted section the 1st outside where a midpoint is combined mostly and inside a longitudinal direction so that about T typefaces may be accomplished toward drawing 14 B, respectively at element slotted-section] radial [left-hand side], and the outer edge and inner edge of an element slotted section 1st radial [this].

[0048] the 2nd E type slot 7-5-2 -- open outer edge [of another side of the coupling track 4-4 of the rotation substrate 1 which it was mostly prepared in radial and the midpoint of the longitudinal direction established in the outside surface of the rotation substrate 1] [-- for example drawing 14 A -- going -- about [of left-hand side outer edge / open /] to operating wavelength] -- 2nd radial element slotted-section [which carries out a correspondence position in the part of one fourth of length] [-- for example It consists of the parallel element slotted section the 2nd outside where a midpoint is combined mostly and inside a longitudinal direction so that about T typefaces may be accomplished toward drawing 14 B, respectively at element slotted-section] radial [right-hand side], and the outer edge and inner edge of an element slotted section 2nd radial [this]. In the example of drawing 14 , while forming circularly and forming suitably the length [track / coupling / 4-4 / of the rotation substrate 1] in alignment with the radii centering on the center of rotation of a substrate 1 in size from operating wavelength The parallel element slotted section of the 1st which forms the coupling slot 7-5 and the 2nd E form slot 7-5-1, the outside of 7-5-2, and the inside is formed in the shape of [centering on the center of rotation of a substrate 1] radii. The length which results in the open outer edge of another side of an inside parallel element slotted section through a radial element slotted section from one open outer edge of the parallel element slotted section of the outside in the 1st and the 2nd E type slot, The length which results in the open outer edge of another side of an outside parallel element slotted section through a radial element slotted section from one open outer edge of an inside parallel element slotted section Respectively by [of operating wavelength] selecting about 1/to the length of 2, and forming suitably in size the length of each longitudinal direction of the 1st and 2nd radial element slotted section

which meets the circumferencial direction of the substrate 1 between midpoints mostly from one half of operating wavelength Other properties except the phase shift property shown in C view among the properties shown in drawing 5 or drawing 8 and the same property can be given.

[0049] In this invention phase shifter with which drawing 15 showed the rotation substrate 1 to drawing 13 and drawing 14 Other properties except the property shown in C view among the properties shown in drawing 5 or drawing 8 , and the same property It is the result of observing the relation between the angle of rotation to the counterclockwise rotation of the rotation substrate 1, and the amount of phase shifts of output terminals 17 and 18 about 885MHz of center frequency of the aforementioned use frequency band using the prototype which selected terms and conditions so that it may be possible to give in operating frequency band of 800MHz. The amount of phase shifts of an output terminal 17 will progress almost linearly, and will be from 0 degree in the amount of phase shifts of an output terminal 18 almost linearly from 0 degree as the rotation substrate 1 rotates counterclockwise so that clearly from drawing.

[0050] Drawing 16 A is drawing showing the outside surface of the rotation dielectric substrate 1 which is the example of invention of a claim 2. In this example, the branching input-line way 2-1 and 2-2 are branched from the end of the input-line way 2. The coupling track 4-1 and 4-2 are prepared through the impedance matching track 3-1 established in the branching input-line way 2-1 and each edge of 2-2 if needed, and 3-2. From the coupling track 4-1 and each open outer edge of 4-2, each length between the part of the length of the simultaneouslies 1/4 of operating wavelength and the input edge (edge located in the center of rotation of a substrate 1) of the input-line way 2 is changed suitably mutually.

[0051] although the internal surface of a substrate 1 is not illustrating this, if it can be set in the example shown in drawing 1 -- the same -- the internal-surface whole region -- grounding -- a conductor -- preparing -- insertion of the inner conductor 22 of the tongue 21 for a rotation drive to the center of rotation of a substrate 1 -- a hole 6 is formed and the coupling slot is prepared in the coupling track 4-1 and the part corresponding to 4-2 Drawing 16 B is drawing showing the outside surface of the fixed dielectric substrate 10 combined with the rotation substrate 1 of drawing 16 A. 12-1 and 12-2 are the wired-AND tracks of each shape of radii centering on a common medial axis with a substrate 1, and operating wavelength has formed about 1/of each radius almost equally to each length between the part of the length of 4, and the center of rotation of a substrate 1 from the coupling track 4-1 and each open outer edge of 4-2.

[0052] 19-1, 19-2 and 20-1, and 20-2 are the breakthroughs for insertion of the outer conductor 23 of the tongue 21 for [2 / 14-/ impedance matching track / which is prepared if needed /, 13-1, 13-2 and 14-1, and] a rotation drive in an output-line way and 11. although the internal surface of the fixed substrate 10 is not illustrating this, if it can be set in the example shown in drawing 1 and drawing 4 -- the same -- the internal-surface whole region -- grounding -- a conductor is prepared, a wired-AND aperture is prepared in the wired-AND track 12-1 and the part corresponding to 12-2, and the output terminal is prepared in the part corresponding to each edge of the output-line way 13-1, 13-2 and 14-1, and 14-2

[0053] Oppose the internal surface of a substrate 1, and the internal surface of a substrate 10 on both sides of the same dielectric sheet metal 8 as a last example also in the example

of drawing 16 in between. The outer conductor 23 of a tongue 21 is inserted in the breakthrough 11 of a substrate 10, and the breakthrough 9 of sheet metal 8. While fixing at the inner edge of the input-line way 2 which inserted the point of the inner conductor 22 of a tongue 21 in the breakthrough 6 prepared in the core of a substrate 1, and prepared the end face of the inner conductor 22 of a tongue 21 in the outside surface of a substrate 1 grounding which formed the outer conductor 23 of a tongue 21 in the internal surface of a substrate 1 -- connection fixing is carried out and interior is carried out to a conductor like a last example at a shielding case

[0054] In the example of drawing 16 , the RF power applied to the input terminal 24 It is distributed to the branching input-line way 2-1 and 2-2 through the inner conductor 22 of a tongue 21 and an outer conductor 23, and the input-line way 2 established in the outside surface of a substrate 1 (instead of distributing to the branching input-line way 2-1 and 2-2 through the input-line way 2). You may form so that the input-line way 2 may be excluded and it may distribute to the direct branching input-line way 2-1 and 2-2. At the same time each distribution power excites the coupling track 4-1 and the input-side excitation circuit which consists of a coupling slot through the impedance matching track 3-1 prepared if needed The coupling track 4-2 and the input-side excitation circuit which consists of a coupling slot are excited through the impedance matching track 3-2 prepared if needed.

[0055] The RF power produced by the electromagnetic wave from an input-side excitation circuit in the wired-AND track 12-1 established in the outside surface of a substrate 10 and 12-2 is transmitted to each each other from each exciting point at a retrose, and is outputted from the output terminal connected to each heel of the output-line way 13-1, 14-1 and 13-2, and 14-2. Since each radius of the circular output-line way 12-1 and 12-2 prepared in the outside surface of a substrate 10 is mutually changed in this example The wired-AND track 12-1, the impedance matching track 19-1 prepared if needed, 20-1, the output-line way 13-1, and the overall length of 14-1, The wired-AND track 12-2, the impedance matching track 19-2 prepared if needed, 20-2, the output-line way 13-2, and the overall length of 14-2 can be changed mutually. According to the angle of rotation of a substrate 1, the output-line way 13-1, the output terminal connected to 14-1 and the output-line way 13-2, the amount of phase shifts of each output of the output terminal connected to 14-2, and a size-related combination of an amplitude can be chosen free.

[0056] Drawing 16 As a coupling slot prepared in the internal surface of a substrate 1 although not shown in drawing at the coupling track 4-1 established in the outside surface of a substrate 1 and 4-2, and a row Although the case where the coupling track 4 shown in drawing 1 and drawing 2 , the same track as the coupling slot 7, and a slot are used is explained this invention can be carried out like the example shown in drawing 16 even if it used a coupling track, a coupling slot, etc. which were shown in drawing 10 or drawing 14 . Many properties which showed formation conditions, such as a coupling track and a coupling slot, to drawing 5 or drawing 9 , and drawing 15 by setting almost like the conditions explained in drawing 10 or drawing 14 , and the same property can be given.

[0057] 2 sets of input circuits which change from the impedance matching track 3-1 established in a substrate 1 side the branching input-line way 2-1 and 2-2, and if needed and 3-2, the coupling track 4-1, and 4-2 to drawing 16 are prepared. Although the case where 2 sets of output circuits which consist of the impedance matching track 19-1

established in a substrate 10 side the wired-AND track 12-1 and 12-2, and if needed, 20-1 and 19-2, 20-2, the output-line way 13-1, 14-1 and 13-2, and 14-2 were prepared was illustrated The input circuit and output circuit of 3 sets or the numbers of groups arbitrary 3 or more sets can be prepared, and this invention can be carried out.

[0058] That is, in this invention, two or more arbitrary phase shifters can be formed using two-sheet 1 set of substrates. In addition, while connecting the input terminal of the phase shifter of the next step to drawing 1 at the output terminal of the phase shifter of the first rank, using this invention phase shifter in which the important section was shown two or more arbitration, two or more arbitrary outputs different mutually [the amount of phase shifts] to an input can be obtained by choosing this number of stages suitably.

[0059] Phase-shift-circuit composition by such connection can be similarly carried out in the example which showed the important section to drawing 16 . Although the case where output terminals 17 and 18 were attached in the internal-surface side of the fixed substrate 10 was illustrated in explanation of drawing 1 You may make it attach in an outside-surface side. in this case Since there is no possibility that each periphery of an output terminal, the rotation substrate 1, and dielectric sheet metal 8 may contact mutually The interval of the center of curvature of the wired-AND track 12 and the attaching position of an output terminal which were established in the outside surface of the restrictions 10 about the attaching position of an output terminal, i.e., a fixed substrate An output terminal can be attached in arbitrary parts, without receiving restrictions of considering as size more suitably than each radius of the rotation substrate 1 and sheet metal 8.

[0060] Moreover, a tongue 21 and the rotation substrate 1 continue for 360 degrees or more in the same direction, and since they are not making it rotate repeatedly Since there is no possibility of producing ****** strong against the track connected to the input terminal 24 attached in a tongue 21 It is not necessarily required to form an input terminal 24 by the coaxial plug, and to make a rotary joint constitute with a tongue 21. The coaxial plug which forms a tongue 21 and an input terminal 24 is replaced by the concentric transmission line. While connecting with the inner edge of the input-line way 2 in which the toe of this concentric transmission line was inserted in the breakthrough 11 of the fixed substrate 10, and the breakthrough 9 of sheet metal 8, and the inner conductor of a concentric transmission line was prepared by the outside surface of the rotation substrate 1 grounding in which the outer conductor was prepared by the internal surface of the rotation substrate 1 -- you may constitute so that it may be made to combine with a conductor 5 electrically mechanically

[0061] The input-line way established in the outside surface of the rotation substrate 1 also in the above and which example, grounding prepared in the internal surface of an impedance matching track, a coupling track, a wired-AND track, an output-line way, and a substrate -- a conductor etc. the conductor of such proper thickness -- a board may be pierced in a necessary configuration, you may stick and form in the outside surface and internal surface of a substrate, and a metal thin layer may be prepared and formed in the outside surface and internal surface of a dielectric substrate by the printed wiring technique and the same technique

[0062] When direct opposite adhesion of each internal surface of the rotation substrate 1 and the fixed substrate 10 is carried out, a possibility that smooth mechanical rotation of the rotation substrate 1 is checked and of it being afraid or producing electric noise etc.,

for moreover, the purpose prevented beforehand grounding prepared in each internal surface of the rotation substrate 1 and the fixed substrate 10 instead of making independent dielectric sheet metal 8 intervene although dielectric sheet metal 8 was made to have intervened between the internal surface of the rotation substrate 1, and the internal surface of the fixed substrate 10 -- you may make it prepare a dielectric layer in which front face of a conductor

[0063] In this invention phase shifter, since the nonlinear element is not used as a constituent child, the way of using which applies an input to any one output terminal, takes out an output from an input terminal, and changes the phase shifter of an output according to the angle of rotation of a rotation derivative substrate is also possible.

[0064]

[Effect of the Invention] this invention phase shifter can adjust the amount of phase shifts continuously and minutely very easily, without requiring great time and a great effort like before. Since the nonlinear element is not used as a constituent child, in excelling in power-proof nature, and inversion use of I/O being possible and using with large power By making dielectric sheet metal intervene between them in opposing each internal surface of a rotation substrate and a fixed substrate a possibility of producing electric noise -- there is nothing -- moreover, a 800MHz band -- setting -- a ratio -- since it is possible to cover 16.5% of band in a band, it uses as constituent children, such as a tilt angle control unit of the array antennas for base stations of a mobile communications method, and is ****** -- it is size

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] In drawing showing the example of invention of a claim 1, A is a side elevation and B and C are a decomposition perspective diagram.

[Drawing 2] A and B are the front view and rear view which looked at the outside surface of the rotation dielectric substrate 1 of drawing 1 , respectively.

[Drawing 3] Front view of the dielectric sheet metal 8 of drawing 1 .

[Drawing 4] A and B are the front view and rear view which looked at the outside surface of the fixed dielectric substrate 10 of drawing 1 , respectively.

[Drawing 5] Drawing showing the property in 0 degree of angles of rotation of the example of drawing 1 .

[Drawing 6] Drawing showing the property in 30 degrees of angles of rotation of the

example of drawing 1 .
[Drawing 7] Drawing showing the property in 60 degrees of angles of rotation of the example of drawing 1 .
[Drawing 8] Drawing showing the property in 90 degrees of angles of rotation of the example of drawing 1 .
[Drawing 9] The graph which shows the relation between the amount of phase shifts of the example of drawing 1 , and an angle of rotation.
[Drawing 10] A and B are the front view and rear view of an example of the rotation substrate 1 in invention of a claim 4.
[Drawing 11] A and B are the front view and rear view of an example of the rotation substrate 1 in invention of a claim 5.
[Drawing 12] A and B are the front view and rear view of an example of the rotation substrate 1 in invention of a claim 6.
[Drawing 13] A and B are the front view and rear view of an example of the rotation substrate 1 in invention of a claim 7.
[Drawing 14] A and B are the front view and rear view of an example of the rotation substrate 1 in invention of a claim 8.
[Drawing 15] The graph which shows the relation of the amount of phase shifts of the example of claims 7 or 8 and angle of rotation using drawing 13 and the rotation substrate 1 of drawing 14 .
[Drawing 16] A and B are the front view showing the example of the rotation substrate 1 in invention of a claim 2, and the fixed substrate 10.
[Description of Notations]
1 Rotation Dielectric Substrate (it is Also Called Rotation Substrate)
2 Input-Line Way
3 Impedance Matching Track
4 Coupling Track
5 Grounding -- Conductor
6 Breakthrough
7 Coupling Slot
8 Dielectric Sheet Metal
9 Breakthrough
10 Fixed Dielectric Substrate (it is Also Called Fixed Substrate)
11 Breakthrough
12 Wired-AND Track
13 14 Output-line way
15 Grounding -- Conductor
16 Wired-AND Aperture
17 18 Output terminal
19 20 Impedance matching track
21 Tongue for Rotation Drive
22 Inner Conductor of Tongue
23 Outer Conductor of Tongue
24 Input Terminal
25 Inner Conductor of Input Terminal
26 Outer Conductor of Input Terminal

2-1, 2-2 Input-line way
3-1, 3-2 Impedance matching track
4-1, 4-4 Coupling track
7-1, 7-5 Coupling slot
12-1, 12-2 Wired-AND track
13-1, 13-2 Output-line way
14-1, 14-2 Output-line way

DRAWINGS

[Drawing 1]

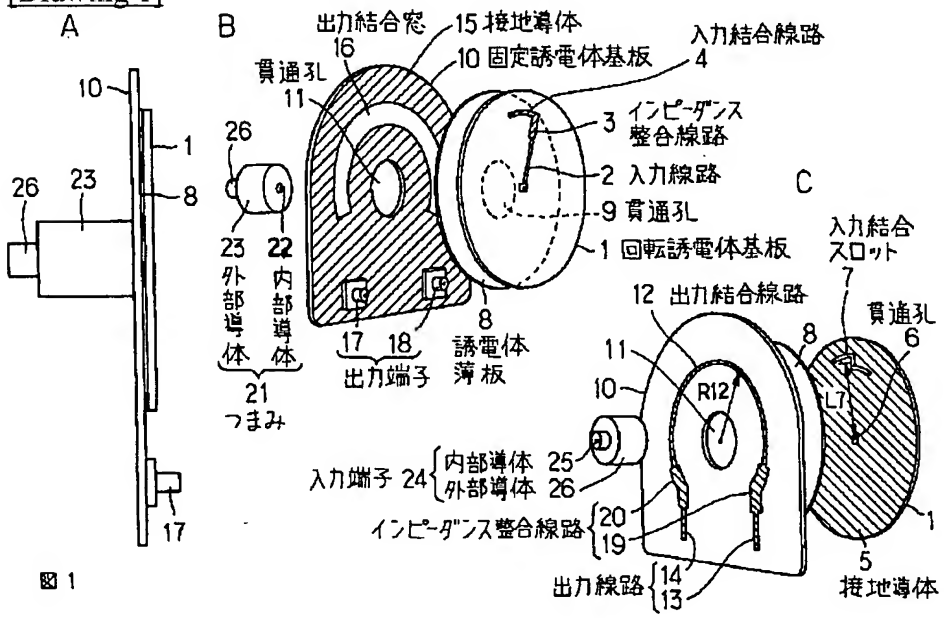
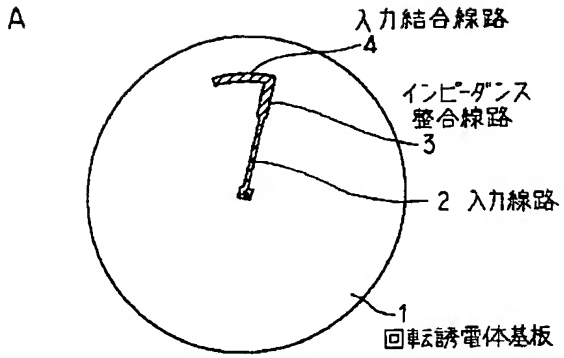


図 1

[Drawing 2]



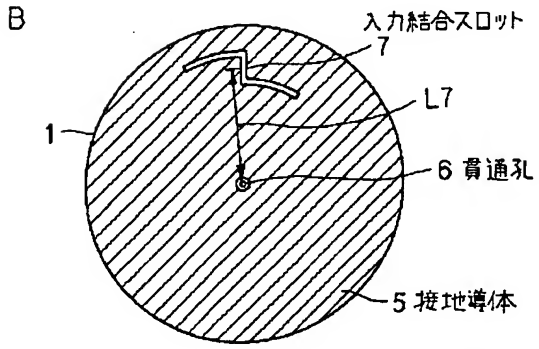


図 2

[Drawing 3]

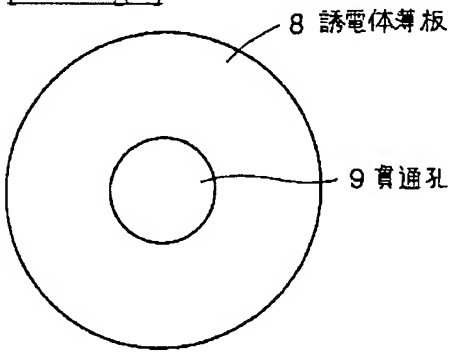


図 3

[Drawing 4]

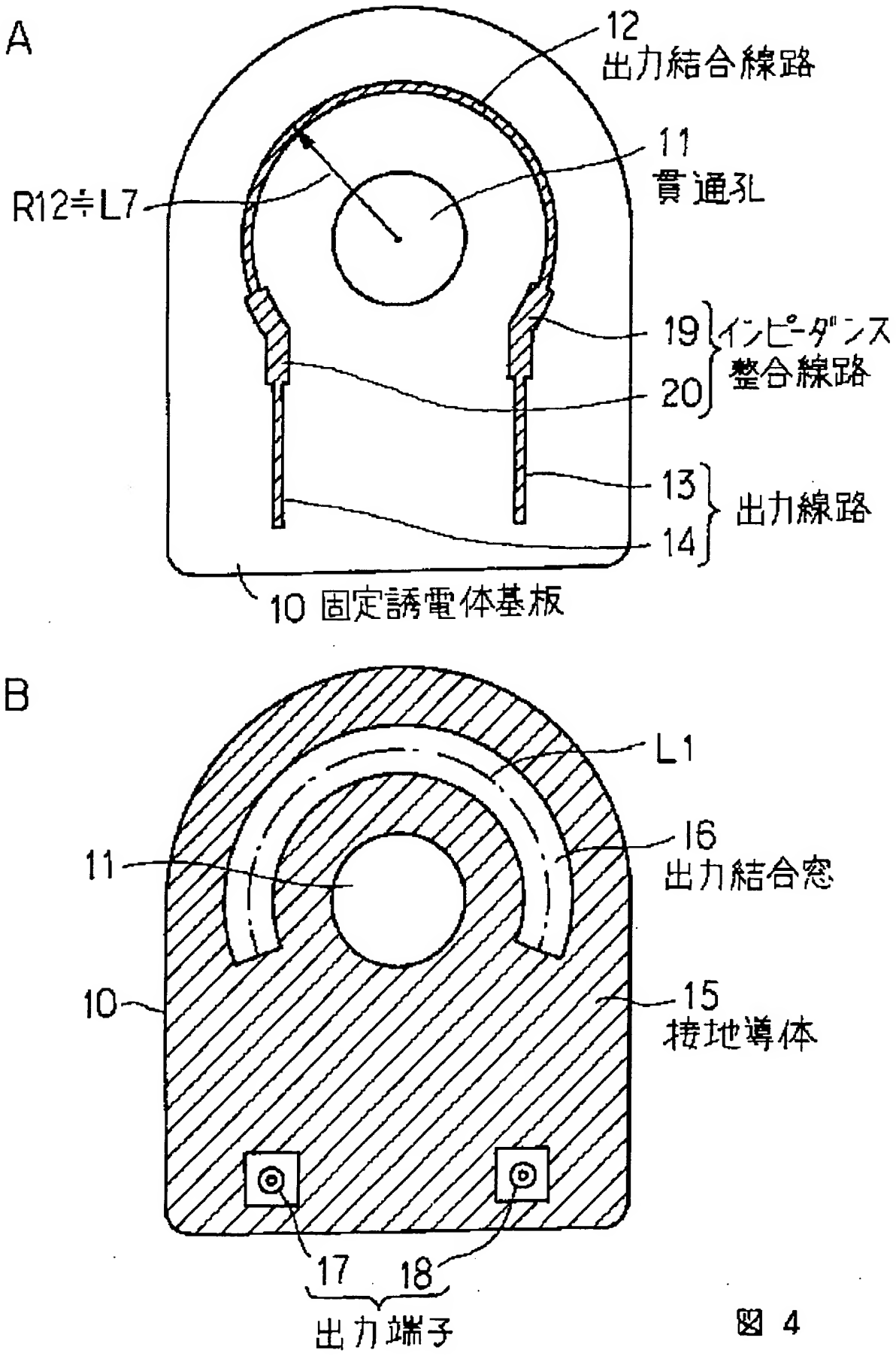

A
12
出力結合線路
11
貫通孔
R12≒L7
19
インピーダンス
整合線路
20
13
出力線路
14
10 固定誘電体基板
B
L1
16
出力結合窓
11
10
15
接地導体
17
18
出力端子

図 4

[Drawing 9]

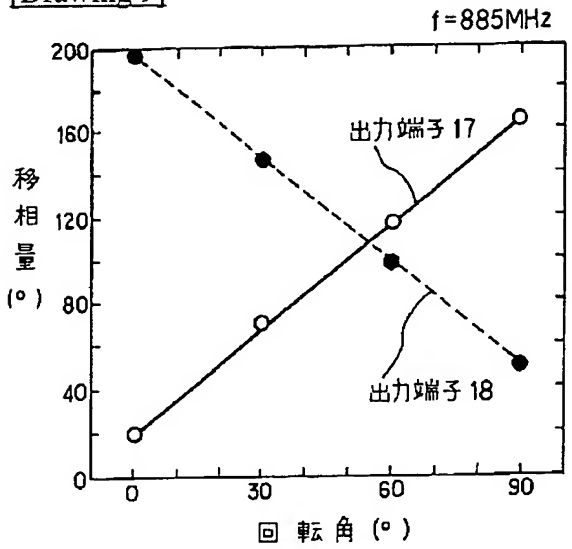


図 9

[Drawing 5]

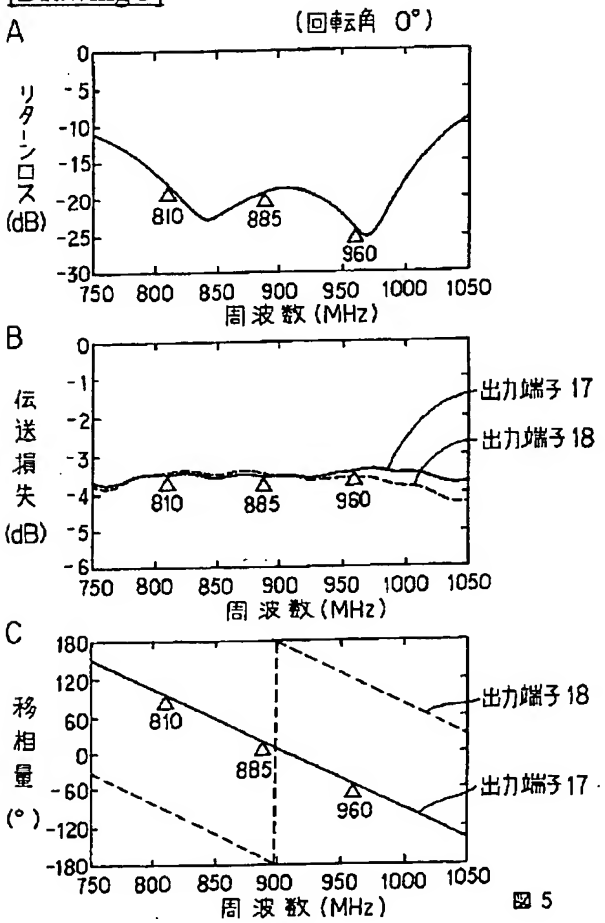
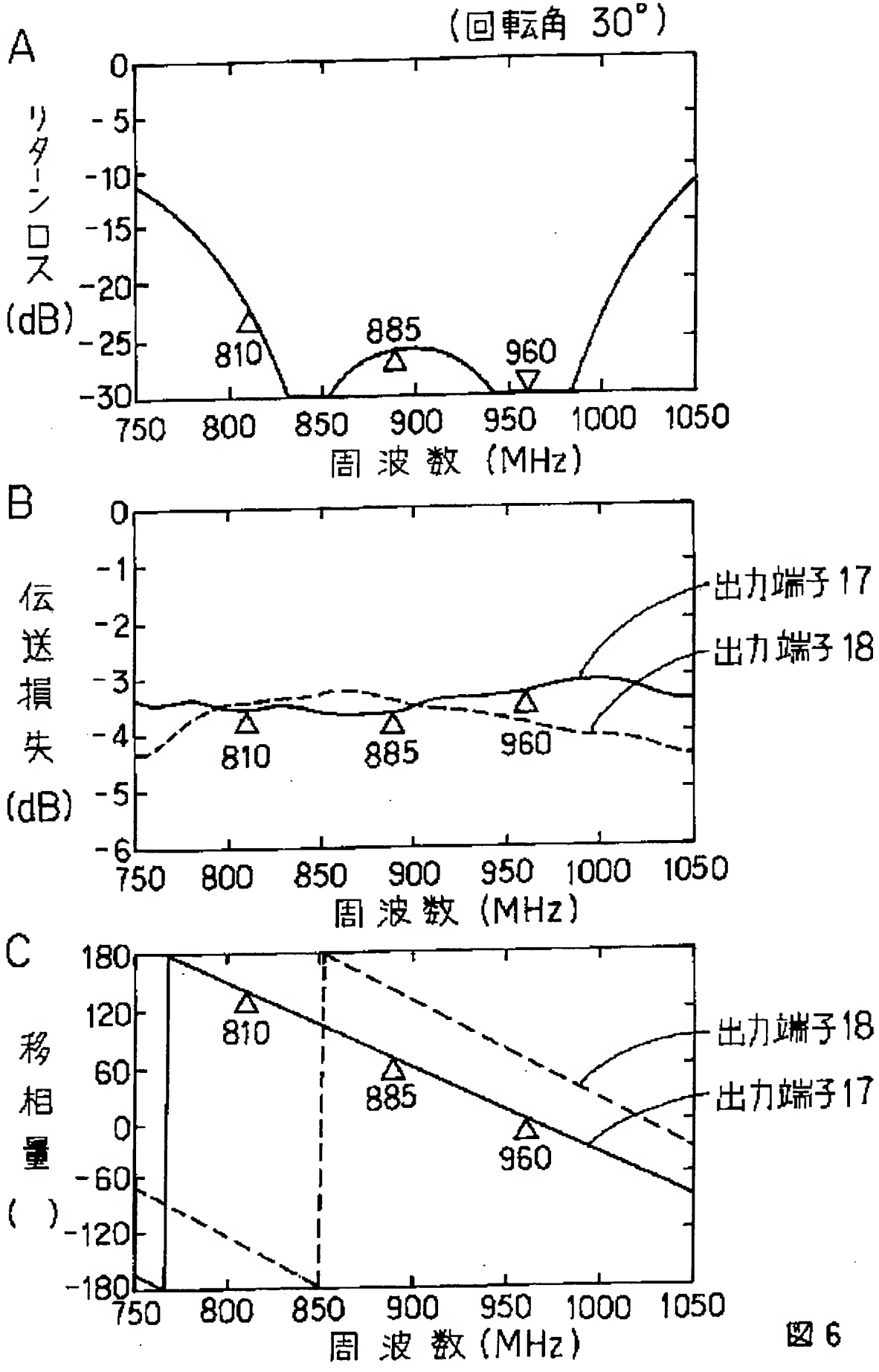


図 5

[Drawing 6]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(回転角 30°)
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(dB)
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-10
-15
-20
-25
-30
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960
750
800
850
900
950
1000
1050
周波数 (MHz)
B
伝送損失
(dB)
0
-1
-2
-3
-4
-5
-6
出力端子17
出力端子18
810
885
960
750
800
850
900
950
1000
1050
周波数 (MHz)
C
移相量
( )
180
120
60
0
-60
-120
-180
810
885
960
出力端子18
出力端子17
750
800
850
900
950
1000
1050
周波数 (MHz)

図 6

[Drawing 15]

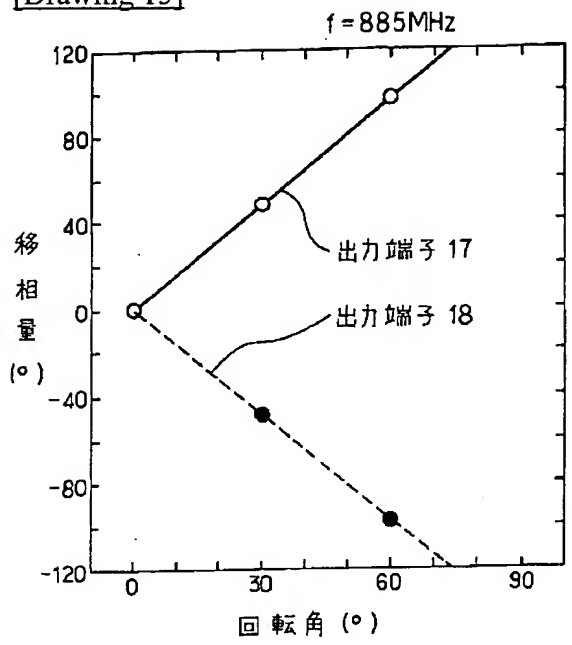
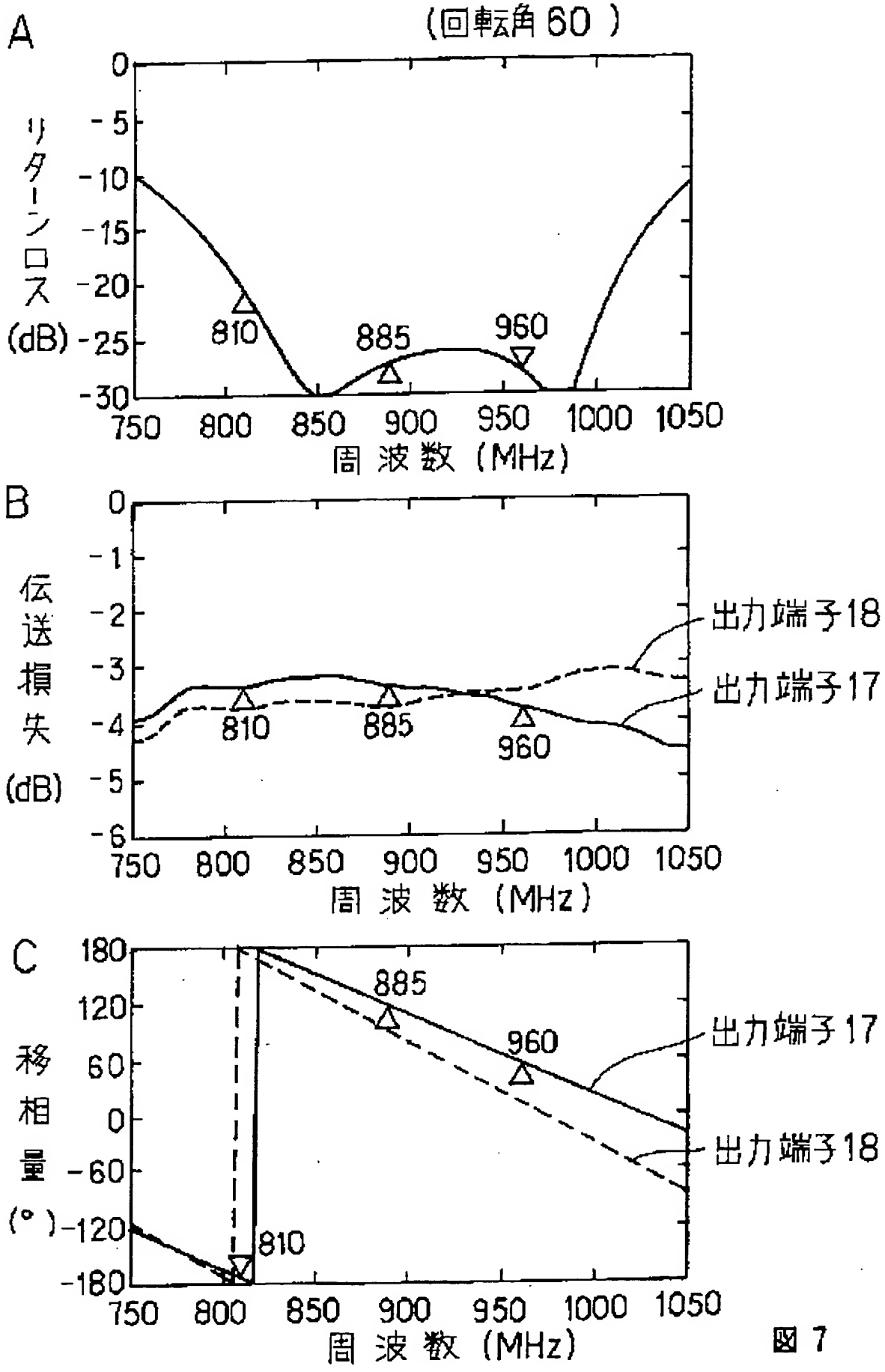


図 15

[Drawing 7]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(回転角 60)
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-10
-15
-20
-25
-30
810
885
960
750
800
850
900
950
1000
1050
周波数 (MHz)
B
伝送損失 (dB)
0
-1
-2
-3
-4
-5
-6
出力端子18
出力端子17
810
885
960
750
800
850
900
950
1000
1050
周波数 (MHz)
C
移相量 (°)
180
120
60
0
-60
-120
-180
885
960
出力端子17
出力端子18
810
750
800
850
900
950
1000
1050
周波数 (MHz)

図 7

[Drawing 8]

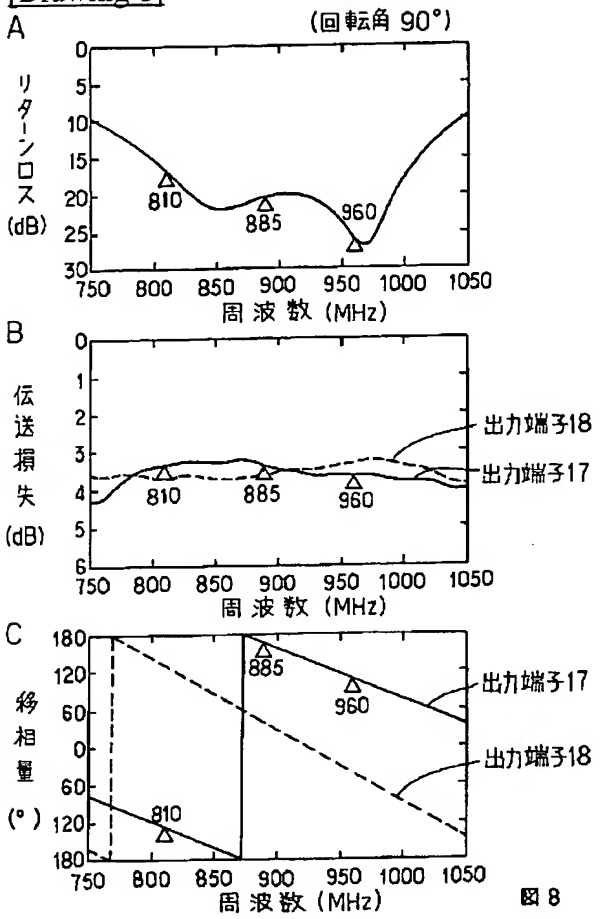


図 8

[Drawing 10]

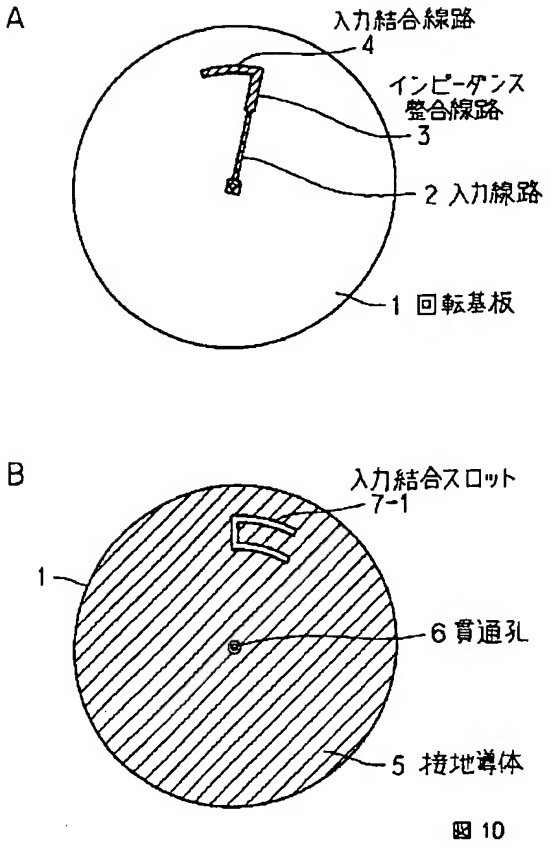


図 10

[Drawing 11]

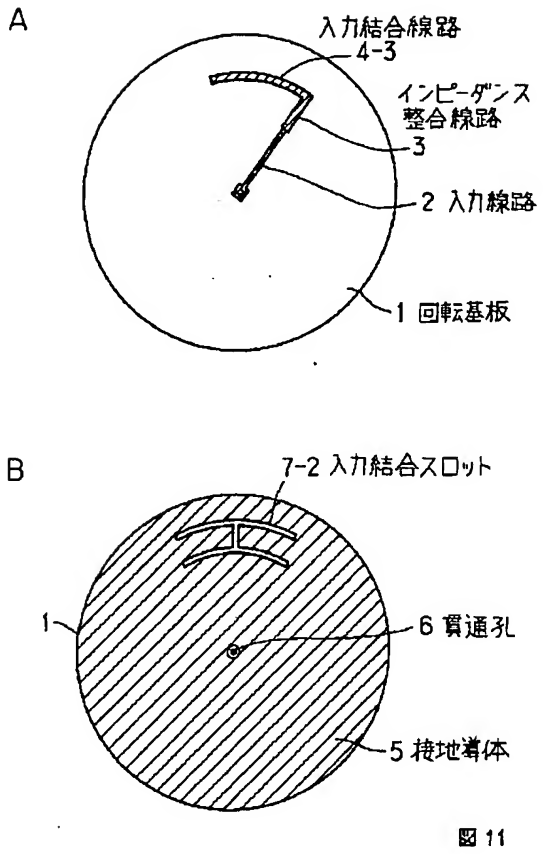


図 11

[Drawing 12]

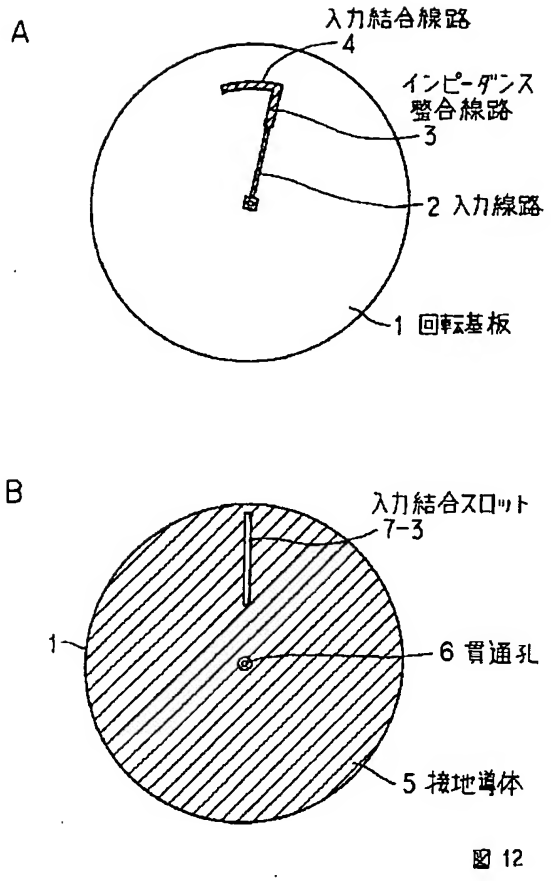
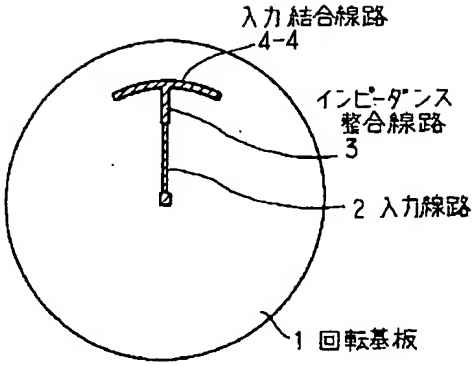


図 12

[Drawing 13]

A



B

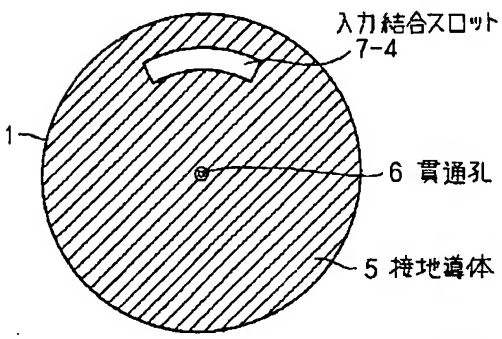


図 13

[Drawing 14]

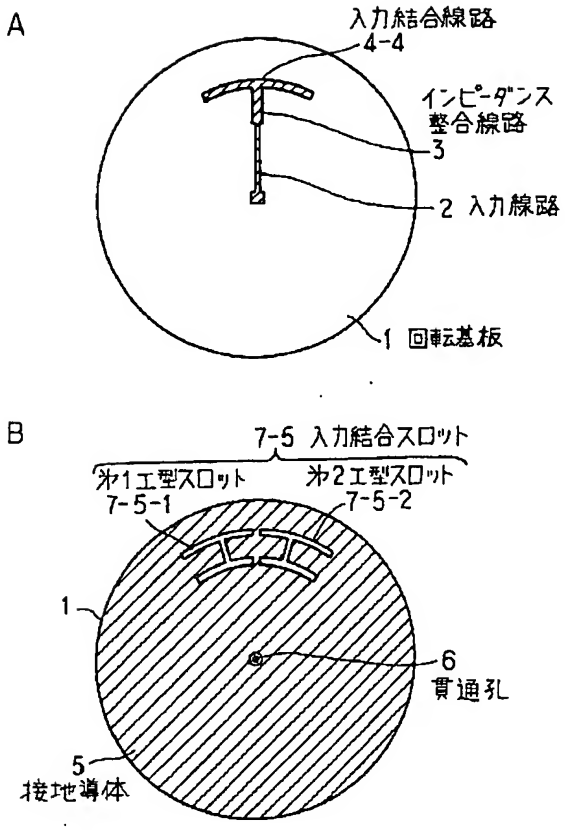
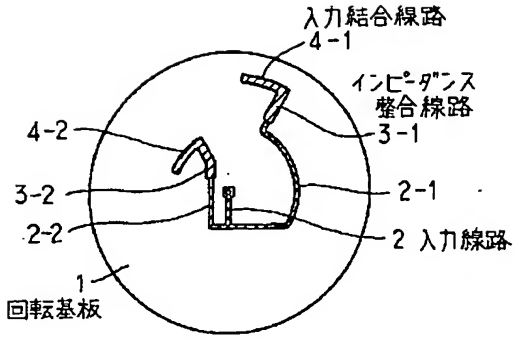


図 14

[Drawing 16]

A



B

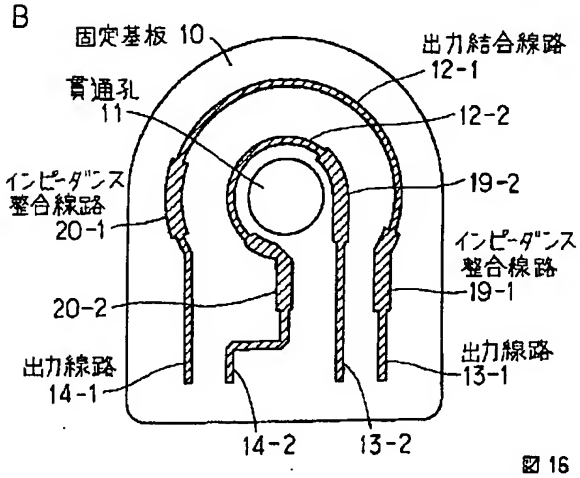


図 16

[Translation done.]